
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

EKC 107 – Organic Chemistry
[Kimia Organik]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of THIRTEEN pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi TIGA BELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instruction: Answer **ALL** (4) questions.

[Arahan: Jawab **SEMUA** (4) soalan.]

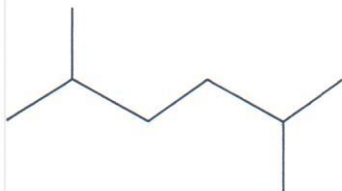
In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]

Answer ALL questions.

1. [a] Give names for the following structures:

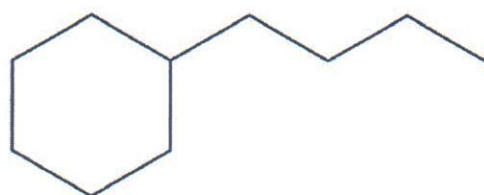
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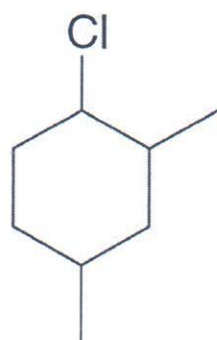
[ii]



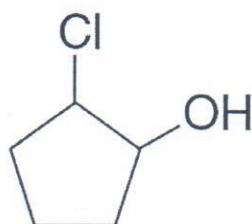
[iii]



[iv]



[v]



[5 marks]

Jawab SEMUA soalan

1. [a] Berikan nama bagi struktur-struktur berikut:

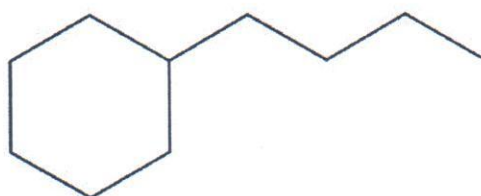
[i]



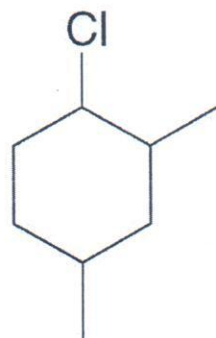
[ii]



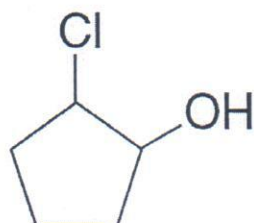
[iii]



[iv]



[v]



[5 markah]

- [b] When light is shined on a mixture of chlorine and chloromethane, methylene chloride (dichloromethane) is one of the products. Write the propagation steps that explain the formation of dichloromethane from chloromethane under these conditions.
[2 marks]
- [c] What is the name of the major monobrominated product which resulted when methylcyclohexane is subjected to $\text{Br}_2/h\nu$ conditions?
[1 mark]
- [d] Name the reaction of propane with bromine?
[1 mark]
- [e] Name the reaction intermediates that have unpaired electrons.
[1 mark]
- [f] *n*-Hexane, C_6H_{14} with structural formula of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ having a slightly higher boiling point of 7.7°C difference as compared to 2-methylpentane with a structural formula of $\text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3$.



Meanwhile, *n*-hexane is known to have much lower melting point in comparison to 2-methylpentane as illustrated in the Table Q.1.[f].

Table Q.1.[f]

Structural formula	Boiling point ($^\circ\text{C}$)	Melting point ($^\circ\text{C}$)
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	68	-95
$\begin{array}{c} \text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	60.3	-153.67

Explain the cause that leads to difference phenomena both for boiling point and melting point as observed above.

[5 marks]

- [g] If you expose a mixture of chlorine and methane to UV light, you get a mixture of organic products.
- [i] Name and write the formula for the organic products.
[5 marks]
- [ii] If you repeat this reaction using bromine rather than chlorine, write the equation for the products to be formed.
[3 marks]
- [iii] If you conduct a reaction involving butane, C_4H_{10} , with chlorine, and only replaced one of the hydrogens by a chlorine atom, write the structural formula for the possible products.
[2 marks]

- [b] Apabila cahaya dikenakan ke atas campuran klorin dan klorometana, metilena klorida (diklorometana) adalah salah satu produk yang terhasil. Tuliskan langkah perambatan yang menjelaskan penghasilan diklorometana daripada klorometana dalam keadaan ini.

[2 markah]

- [c] Apakah nama produk monobromin utama yang terhasil apabila metilsikloheksana didedahkan dengan $\text{Br}_2/\text{h}\nu$?

[1 markah]

- [d] Namakan tindak balas propana dengan bromin?

[1 markah]

- [e] Namakan tindak balas perantaraan yang mempunyai elektron tidak berpasangan.

[1 markah]

- [f] *n*-Heksana, C_6H_{14} dengan formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ mempunyai takat didih yang lebih sebanyak 7.7°C berbanding 2-metilpentana yang mempunyai formula struktur $\text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3$.



Walau bagaimanapun, *n*-heksana dikenalpasti mempunyai takat lebur yang lebih rendah berbanding 2-metilpentana seperti ditunjukkan dalam Jadual S.1.[f].

Jadual S.1.[f]

Formula struktur	Takat didih ($^\circ\text{C}$)	Takat lebur ($^\circ\text{C}$)
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	68	-95
$\begin{array}{c} \text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	60.3	-153.67

Terangkan mengapa terjadinya perbezaan bagi takat didih dan takat lebur seperti ditunjukkan dalam Jadual S.1.[f].

[5 markah]

- [g] Sekiranya anda mendedahkan campuran klorin dan metana kepada cahaya UV, anda akan memperolehi campuran produk organik.

- [i] Namakan dan tuliskan formula bagi produk-produk organik.

[5 markah]

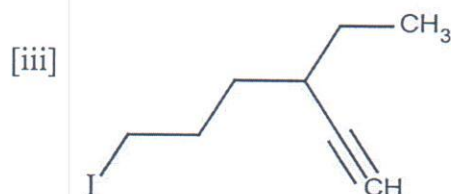
- [ii] Sekiranya anda mengulangi tindak balas yang sama dengan bromin, tuliskan persamaan bagi produk-produk yang akan terhasil.

[3 markah]

- [iii] Sekiranya anda menjalankan tindak balas melibatkan butana, C_4H_{10} , dengan klorin dan hanya menggantikan salah satu hidrogen dengan hanya atom klorin, tuliskan formula struktur bagi produk-produk yang mungkin terhasil.

[2 markah]

2. [a] Name the following structures:



[3 marks]

[b] Explain what is carbocation and in which reaction it involves. Include the stability of carbocation in your explanation.

[5 marks]

[c] Define the following:

- [i] Markovnikov addition mechanism
- [ii] Electrophilic addition mechanism

[2 marks]

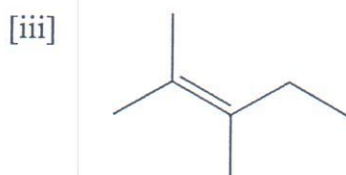
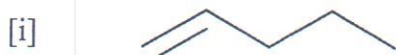
[d] Chain branching of polyethylene is known to produce two different polymer name as High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE). These two polymers possess distinguished differences and amongst it is their toughness properties. Indicate the reason causing HDPE stronger than LDPE.

[2 marks]

[e] Outline the complete mechanism showing how 2,3-dimethyl-2-butanol is formed in the acid-catalyzed hydration of 3,3-dimethyl-1-butene.

[10 marks]

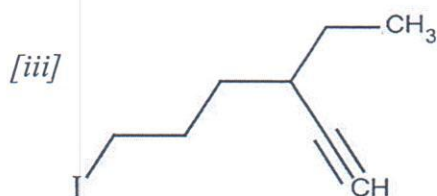
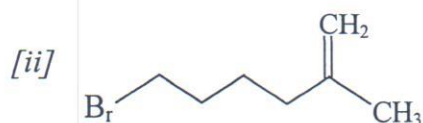
[f] Name and rank the following alkenes as to their relative rate of reaction with HBr from the slowest to fastest :



[3 marks]

...7/-

2. [a] Namakan struktur-struktur berikut:



[3 markah]

[b] Terangkan apakah karbokation dan dalam tindak balas apakah ianya terlibat. Jelaskan juga kestabilan karbokation di dalam penjelasan yang diberikan.

[5 markah]

[c] Berikan definisi bagi setiap yang berikut:

[i] Mekanisma penambahan Markovnikov

[ii] Mekanisma penambahan elektrofilik

[2 markah]

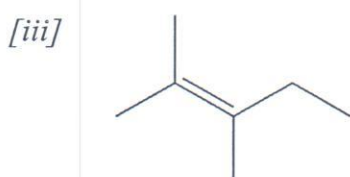
[d] Percambahan cabang bagi polietilina dikenali pasti dapat memberikan 2 polimer berbeza seperti Polietilina Ketumpatan Tinggi (HDPE) dan Polietilina Ketumpatan Rendah (LDPE). Kedua-dua polimer ini mempunyai perbezaan yang ketara dan salah satunya ialah sifat kekuatan. Jelaskan faktor menyebabkan HDPE lebih kuat berbanding LDPE.

[2 markah]

[e] Berikan mekanisme lengkap menunjukkan bagaimana 2,3-dimetil-2-butanol terhasil daripada penghidratan bermangkin-asid 3,3-dimetil-1-butena.

[10 markah]

[f] Namakan dan susunkan alkena berikut mengikut kadar tindak balas relatif dengan HBr daripada terlambat kepada tercepat :



[3 markah]

3. [a] Lukiskan struktur-struktur sepadan bagi nama-nama berikut:

- [i] 2-Metil-3-heptanon
- [ii] 3-Fenil-2-propenal
- [iii] Keton aromatik, $C_9H_{10}O$

[3 markah]

[b] Ramalkan hasil-hasil tindak balas antara fenilasetaldehyd dan asetofenon dengan menggunakan reagen berikut:

- [i] CH_3MgBr dan kemudian H_3O^+
- [ii] H_2NNH_2 , KOH
- [iii] $2CH_3OH$, mungkin HCl

[3 markah]

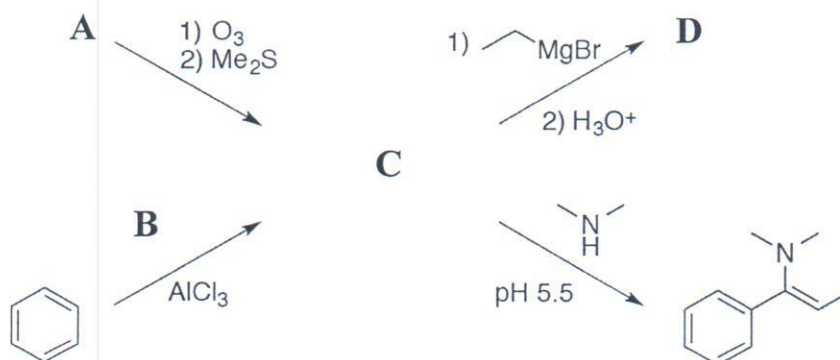
[c] Bagaimana anda akan menggunakan tindak balas Grignard pada aldehid atau keton untuk menghasilkan sebatian berikut? Sertakan mekanisma tindak balas.

- [i] 3-Pentanol
- [ii] Difenilmethanol

[3 markah]

[3 markah]

[d] Kenalpastikan sebatian A, B, C dan D



[4 markah]

[e] Berikan reagen-reagen yang perlu bagi sintesis efisien untuk yang berikut :

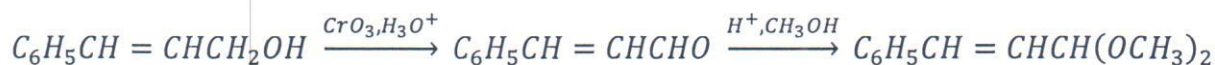


[3 markah]



[3 markah]

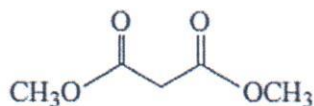
[f] Correct the following reaction scheme below:



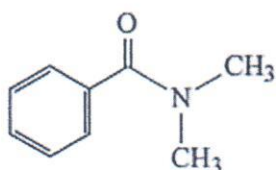
[3 marks]

4. [a] Give the IUPAC names for the following compounds

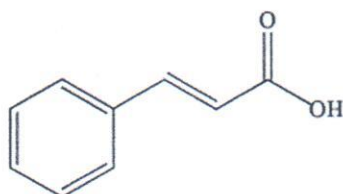
[i]



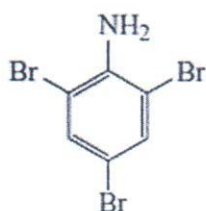
[ii]



[iii]

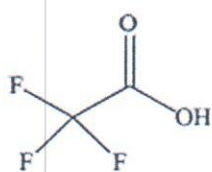


[iv]

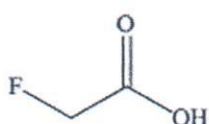


[4 marks]

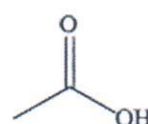
[b] Rank the following according to acid strength, from the weakest to strongest.



[I]



[II]



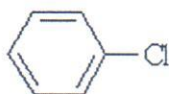
[III]



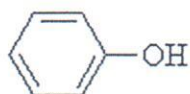
[IV]

[2 marks]

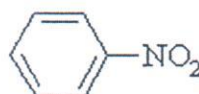
[c] Arrange the following in accordance to their relative rate of reaction with Br_2/Fe . Justify your order.



[I]



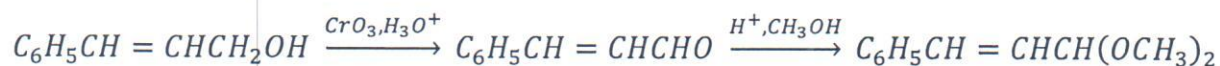
[II]



[III]

[4 marks]

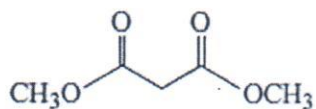
[f] Betulkan skema tindak balas di bawah:



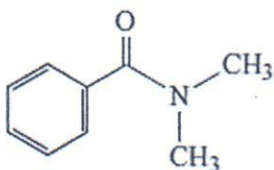
[3 markah]

4. [a] Berikan nama IUPAC untuk sebatian berikut

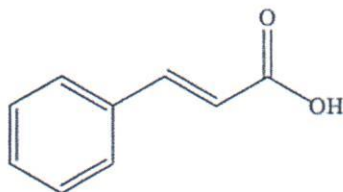
[i]



[ii]



[iii]

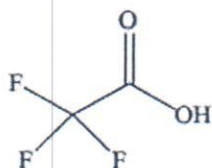


[iv]

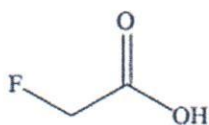


[4 markah]

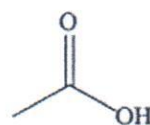
[b] Aturkan yang berikut mengikut kekuatan asid, dari lemah kepada kuat.



[I]



[II]



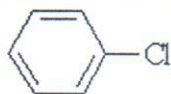
[III]



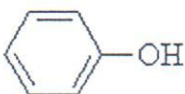
[IV]

[2 markah]

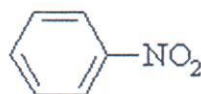
[c] Susun yang berikut mengikut kadar relatif tindak balas dengan Br_2/Fe . Berikan alasan anda.



[I]



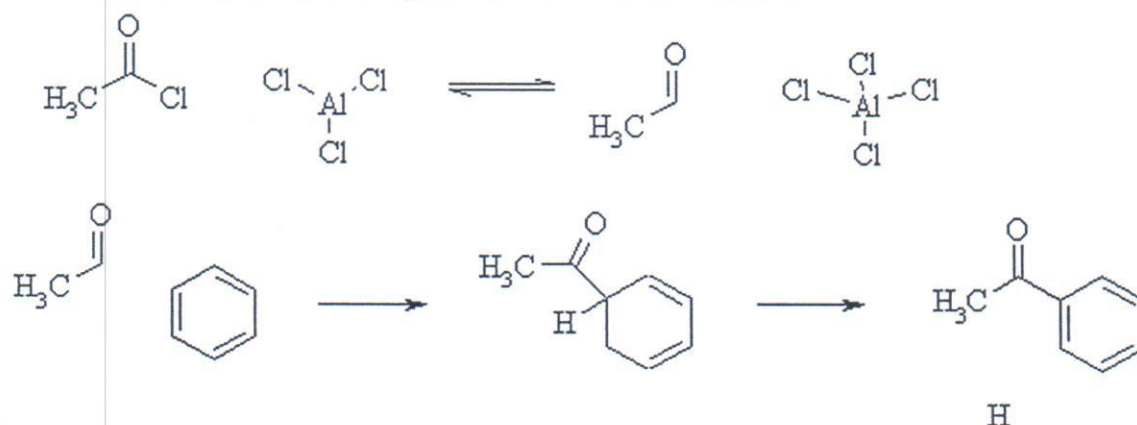
[II]



[III]

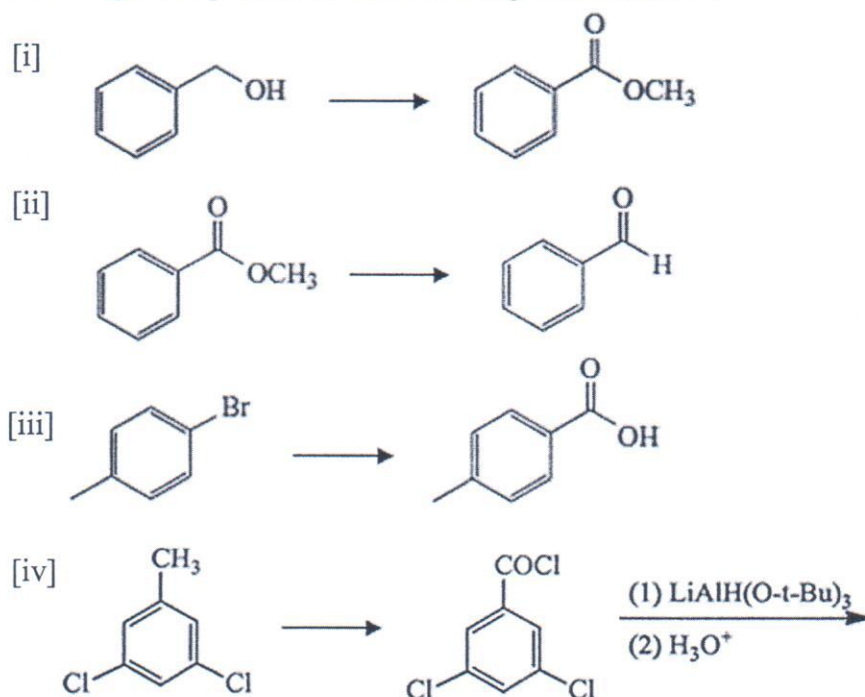
[4 markah]

- [d] Draw the arrows to indicate the flow of electrons for each of the following reaction scheme. All the required bonds have been shown.



[4 marks]

- [e] Indicate the reagent or product of the following transformation



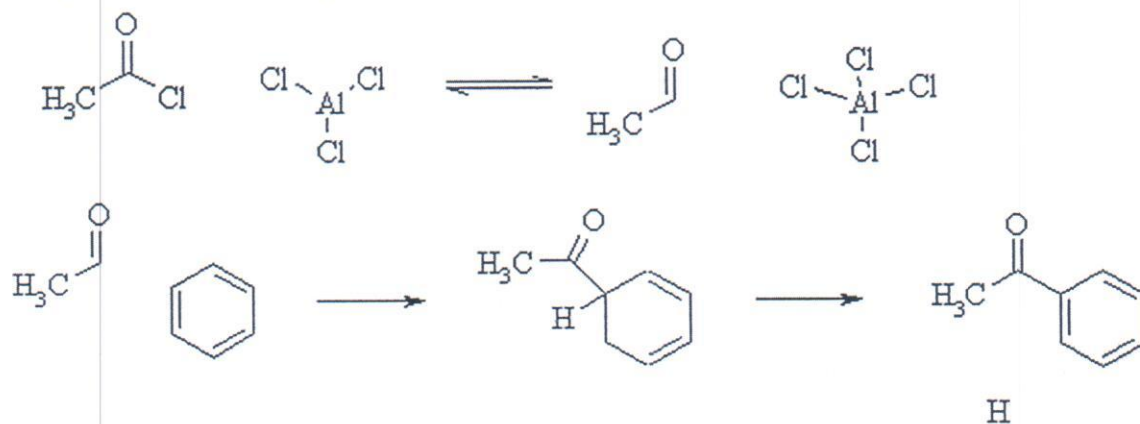
[5 marks]

- [f] Predict the major product (or products) formed when the following reacts with a mixture of concentrated HNO_3 and H_2SO_4 .

- [i] Phenyl benzoate
- [ii] Toluene
- [iii] Fluorobenzene

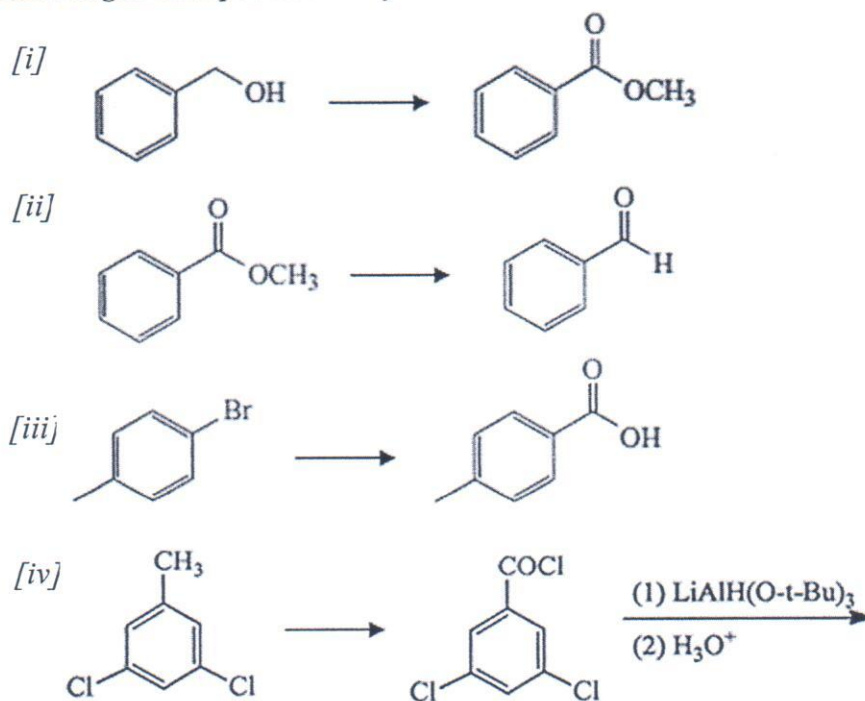
[6 marks]

- [d] Lukiskan anak panah untuk menunjukkan langkah demi langkah mekanisma lengkap bagi setiap skema tindak balas berikut. Semua ikatan-ikatan yang diperlukan telah ditunjukkan.



[4 markah]

- [e] Kenalpasti reagen atau produk transformasi berikut.



[5 markah]

- [f] Ramalkan hasil utama (atau hasil-hasil) terbentuk apabila yang berikut bertindak balas dengan campuran HNO_3 pekat dan H_2SO_4 .

- [i] Fenil benzoat
- [ii] Toluena
- [iii] Fluorobenzena

[6 markah]